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COMMUNICATIONS

THE FUNCTION OF THE PECTEN

BY

IDA C. MANN

(HENRY GEORGE PLIMMER RESEARCH FELLOW)

LONDON

ANY adventurer into the realms of comparative ophthalmology can hardly fail to have had his attention attracted by the curious appearance of the *fundus oculi* of the bird. In the first place the entire absence of any obvious retinal blood-vessels is remarkable, and in the second place the optic disc itself presents several points of difference from the mammalian type. The most arresting feature of the ophthalmological picture is the pecten. This appears as a deep black mass, of a velvety texture and very beautifully convoluted. It projects from the optic disc (which is linear, not circular), and extends forwards into the vitreous in the lower part of the eye, its anterior end being free. This pecten is found substantially the same in all classes of birds, though it is subject to a great many variations as regards shape, size and number of folds. In its simplest form, without any convolutions at all, it is found in the apteryx, the fundus of which in this respect resembles that of many of the lizards. The function and morphological meaning of this structure have been inquired into from time to time but with very divergent results, so that the present paper is perhaps justified if only as a consideration of the various possibilities.

The pecten of the domestic hen (*Gallus domesticus*), which furnished most of the material for this paper, presents eighteen folds, and measures on an average 8 mm. at its base and 5 mm. at its broadest part. The folds are united together along the free edge by a band of slightly denser tissue known as the *bridge*. The base of the pecten is attached along the whole length of the

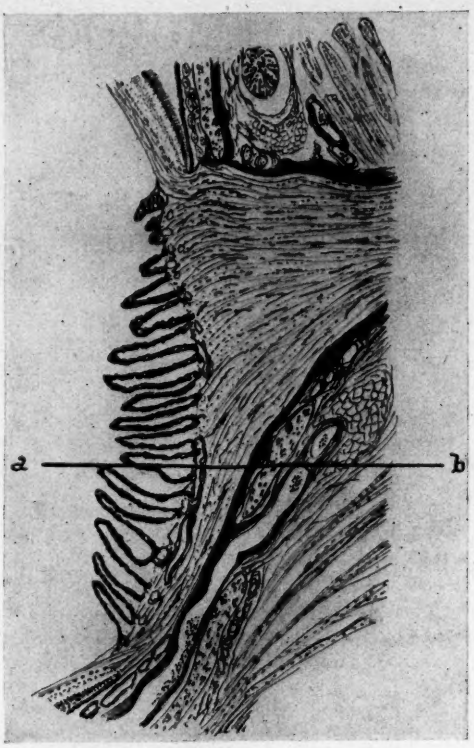


Fig. 1.

Longitudinal section of pecten of *Gallus domesticus*.

linear optic disc, that is to say, along a line corresponding to the nerve head proper and the *cauda* or tailed out lower portion of nerve. Fig. 1 shows a somewhat diagrammatic section through the nerve and pecten longitudinally. The pecten is densely pigmented and extremely vascular. Its vessels of supply reach it along its attached border. There are one or sometimes two small arteries which reach it by running through the fibres of the optic nerve, the main one in the upper part of the nerve, the second

near its middle. This last may be represented by more than one vessel. These may anastomose with other small vessels of the nerve itself and of its sheath. The main artery runs down the base of the pecten and gives a branch of supply to each of its folds. A vein comes from each fold and joins the main vein which runs down the base, occasionally communicating by small collaterals with the two veins running down, one on each side of the *cauda* (inside the sclerotic). Just above the lower end of the *cauda* these two veins join a large vein which is running upwards between the retina and the sclerotic along the old line of the fissure. This

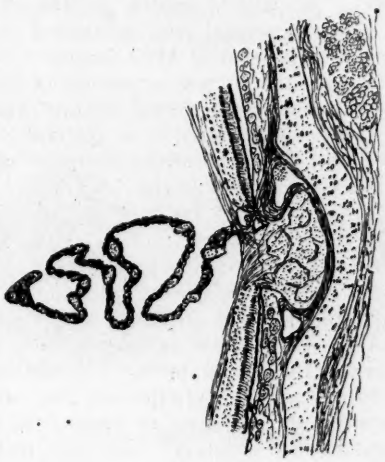


Fig. 2.

Transverse section of pecten through *a b* in Fig. 1.

vein receives large choroidal veins from the lower part of the eye and also the main vein of the pecten. It leaves the eye by passing through a foramen in the cartilaginous sclerotic at the lower end of the *cauda*. Fig. 2 shows a transverse section through the pecten and *cauda* at the level of the line *a b* in Fig. 1.

In considering the function of the pecten the chief possibilities for consideration are as follow:

It may be connected with the mechanism of accommodation.

It may be nutritive in function.

It may regulate the intraocular tension.

It may modify in some way the operation of the eye as an optical instrument and affect the formation of images on the retina.

It may be a sense organ.

An attempt will be made to settle some of these points by an inquiry into:

1. The minute structure of the pecten tissue.
2. Its situation and optical properties.
3. The intraocular nutrition of pectinate and non-pectinate eyes.
4. The development of the pecten.

In the first place the minute structure of the pecten in the adult bird must be examined since it is necessary to discover whether it possesses muscle cells, nerves, secreting cells or other tissues, the presence or absence of which would go far in deciding its capabilities. There exist several descriptions of the histology of it, one of the earliest being that of Mihalkovics (1873). He wrote refuting the earlier idea that it was a portion of the choroid coat which had passed through the foetal fissure and proliferated inside the eye. He showed that it was not continuous with the choroid and that it did not structurally resemble choroidal tissue except in its extreme vascularity. He described it as a capillary network, each capillary having an endothelial lining and being surrounded by a structureless hyaline coat. Leuckart (1876) and Kessler (1877) returned to the earlier view that it was an accessory part of the choroid, while this was again denied by Denissenko (1881) Gegenbauer (1898) and Rabl (1898). Denissenko described the capillaries as possessing an adventitia and a surrounding hyaline membrane, while those of the choroid do not. This adventitial coat forms a thin cylinder around the vessel, the minute space between the cylinder of adventitia and the vessel wall being crossed by fine strands. Outside this cylinder is a homogeneous pigment-containing layer, which was described by Kessler and Mihalkovics as the adventitia, but which Denissenko considers as a supporting connective tissue framework for the whole capillary net.

In 1905 Bernd suggested that the pecten was an ectodermal structure and in 1908 Franz published a paper that put forward the view that it was of the nature of a glial network highly vascularized by capillaries and having along the free edge of the *bridge* certain small projections with cilium-like extremities which he took to be sensory hairs. He also described certain bulbous cells with filaments which joined the general glial network. He thought that he could demonstrate a continuity of nerve fibrils between the pecten and the nerve fibre layer of the retina along the line of attachment of the pecten to the optic nerve. He failed to find true connective tissue in the pecten and says the blood-vessels have no adventitia, though he describes three layers in much the same way as Denissenko, but under different names.

Casey Wood, in 1917, stated that he was unable to find any sensory hairs or other evidence of the nervous nature of the pecten and considered it as nothing more than a capillary network.

The following description is from sections 2 μ thick of the pecten and adjacent retina of a perfectly fresh hen's eye fixed in Bouin's fluid. It differs in some respects from the earlier descriptions, chiefly those of Franz and Denissenko. Firstly, I have been unable to confirm Franz's findings of sensory hairs and end bulbs in the specimens I have examined, and secondly, Denissenko's description of the blood-vessels as lying within cylinders of adventitia and separated from them by a space seems to me not to have been founded on fresh well-fixed specimens. I have seen somewhat similar appearances in some of my earlier

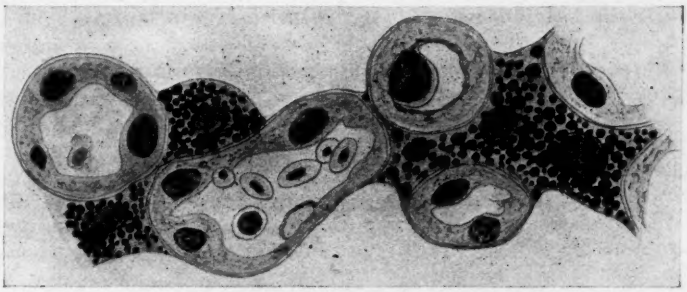


Fig. 3.

Portion of pecten (high power).

material, which had been killed some hours before fixation in 10 per cent. formol, but I do not think such specimens give an accurate idea of the minute structure, as disintegration begins very rapidly in these delicate tissues.

Fig. 3 shows a high-power drawing of a small portion of the adult pecten. It is composed mainly of capillaries. Four of these and a portion of two others are shown cut in the section. They are very small and their wall is composed of a single layer of cells. These are presumably endothelial cells, but they are not typical. The nuclei are very large, oval with a darkly staining nucleolus and prominent chromatin. The cytoplasm, instead of being thinned out almost into a film as generally in capillaries, appears swollen into a structureless clear homogeneous mass in which the nuclei are embedded at intervals, no individual cell boundaries being seen. Outside this homogeneous cytoplasm and not anywhere separated from it is a perfectly clear hyaline and highly refractile limiting membrane, which completely invests every

capillary. This is difficult to represent in a drawing. It does not stain and stands out sharply in the sections as a perfectly clear thin shining line. There is no true adventitia. The capillaries contain nucleated oval red blood cells. The individual capillaries are often in direct contact with each other and also with the hyaloid membrane of the vitreous. In places, however, one finds between them other cells, rather more epithelial in type, and having a round and darkly staining nucleus and possessing no hyaline limiting membrane. The cytoplasm of these cells is crowded with pigment granules, which are in thick sections so numerous as entirely to mask everything else. In thin sections one can easily see the individual granules lying in the cytoplasm, the nucleus being in the centre. These pigment granules are all

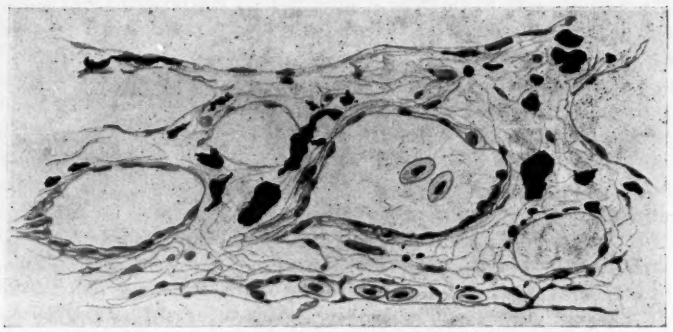


Fig. 4.

Portion of choroid (high power).

spherical and of very varying sizes: a single cell may contain as many as 60 or 100 granules, some very large, others only just perceptible. Sometimes several of these pigment cells lie in direct contact, sometimes one only between two capillaries. They tend to be stellate in outline, filling the spaces between the rounded capillaries. The pigment granules very readily come out of the cells, and in thick or imperfectly fixed sections the whole slide may be peppered with them. The pigment-containing cells I look on as the remains of the primitive or epithelial pecten, the development of which from the inner layer of the optic cup I have already described in this journal. They are more numerous along the bridge of the pecten than in the folded part, but they are everywhere sufficiently numerous to give the entire pecten a deep black colour.

Fig. 4 shows a high-power drawing of a portion of the *choroid* from the same eye as Fig. 3 for comparison. It can be seen that

there is very little similarity. The choroidal vessels are mostly larger. Their walls are lined with flattened endothelium and are sometimes more than one cell thick, indeed, definite venules and arterioles can be made out among the larger vessels. There is a definite adventitia. There is no trace of the curious swollen appearance of the cytoplasm seen in the endothelium of the pecten capillaries and no hyaline limiting membrane. The individual capillaries are not often in contact, being all embedded in a fine areolar tissue network, in which are also the pigment cells. The pigment granules are individually very much smaller, but are present in the cell in very much larger numbers so that even in thin sections no definite structure can be made out.

From a consideration of the structure alone then we arrive at certain facts with a definite bearing on the function of the pecten. These are as follow:

The pectinal tissue consists of capillaries with specialized walls containing no unstriped muscle and no nerve fibres. Between the capillaries are epithelial pigment-containing cells, the remains of the primitive epithelial pecten. There are no structures suggestive of end organs or sensory hairs.

Take first the various theories which have connected the pecten with the mechanism of accommodation. It has been thought that the pecten might by alteration in shape or volume push forward the lens and so render the eye adapted for near vision. If the pecten exercised a direct propulsive action on the lens one would expect them to be at least in contact, which is not the case, while if the forward movement of the lens was brought about by an increase in tension in the posterior part of the eye one would expect to find some contractile mechanism in the pecten whereby its size could be actively altered. Instead one finds entire absence of any sort of vaso-motor mechanism and it is hard to see how the organ can alter in size or shape, except passively in response to changes in the general blood pressure. Indeed, it was pointed out by Beauregarde in 1875 that the pecten possessed no intrinsic power of movement. He examined the pecten ophthalmoscopically in the living bird, and described three movements of it which he classified as apparent (due to movements of the whole head), transmitted (communicated to the pecten by the contractions of pyramidalis and quadratus during movement of the nictitating membrane) and thirdly, pulsations due to the circulation in the pecten vessels. He showed by direct stimulation of the pecten and section of the muscles that it possessed no intrinsic power of movement. He supposed that it might be of use in uniocular fixation to suppress the images seen in common by both eyes. The observations concerning the movements of the pecten were confirmed by Abelsdorff in 1910.

Although the turgidity of the pecten possibly varies with the general blood pressure it can be easily shown that neither the turgidity of the pecten nor the general blood pressure exercises any influence over the refraction of the eye. The following experiments were performed:

Experiment 1. A retinoscopy was performed on a live hen and its refraction found to be +1.5D sph. It was then killed by cutting off its head and the blood was allowed to drain out of the head. The refraction of the eye was again estimated and was found not to have altered. To this it might be objected that although draining out the blood undoubtedly produced a fall to zero in the general blood pressure yet this might have been compensated for by a reflex constriction (at the moment of death) of the main vessels of supply to the pecten outside the eye so that the blood in the pecten vessels at the time could not drain away and its volume consequently remained unaltered. To obviate this difficulty a second experiment was done.

Experiment 2. A retinoscopy was done on another hen (+2.5D sph.). It was then caused to inhale amyl nitrite until a very marked increase in the respiration rate occurred. The refraction was again estimated and showed no change. This experiment is not open to the same objection as the preceding one since amyl nitrite produces a fall in the blood pressure by a direct paralysing effect on the unstriped muscle of the walls of arterioles and not by a selective nervous action. The retinal arteries in man can be seen to dilate during its administration.

I think, therefore, that one can say that the pecten exerts no influence over the refraction of the eye.

With regard to a possible sensory function Franz suggested that the pecten might act as a detector of the slight hydrodynamic changes in pressure in the vitreous coincident with changes in the accommodation, and that the sensations of pressure change so received might serve to apprise the bird of the amount of accommodative effort expended, and thus lead to the judgment of the relative distances of objects looked at. Histologically the only ground for such a theory is the presence of epithelial cells derived from neural ectoderm. This does not of necessity imply a neural function, since this becomes lost in other structures developed from the neural tube, e.g. the posterior layers of the iris.

The possibility of a nutritive function for the pecten must be considered while its histology is being dealt with. The great vascularity and the peculiar specialization of the walls of its blood-vessels and the fact that these are often in direct contact with the hyaloid membrane of the vitreous seem to show that there may be some selective interchange between the fluid in the vessels and the

fluid in the meshes of the vitreous. It is possible that this swollen type of endothelium signifies that the vessel wall is exercising a special selective action on the fluid passing out of the vessel. One sees, perhaps a comparable thing in the wall of a capillary in a renal glomerulus, the endothelium of which is syncytial in type, with no boundaries between the individual cells. Denissenko considered that the fluid would have some difficulty in passing through the hyaline membrane which surrounds each capillary and he, therefore, supposed that the pectinal lymphatic spaces (which he thought to be between the capillary wall and this hyaline

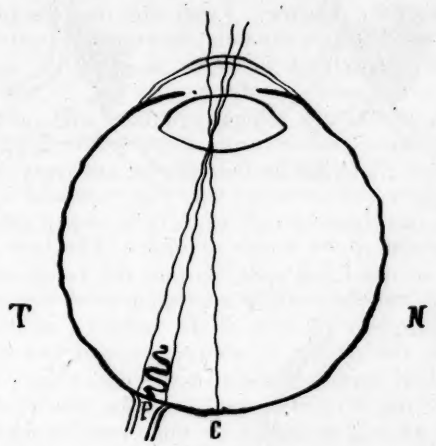


Fig. 5.

Diagram showing optical effect of pecten. T=temporal side. N=nasal side. P=optic nerve and area of pecten shadow. C=centre of posterior pole.

membrane) communicated at the base of the pecten with the lymphatics of the retina and that an interchange took place in this way only. This difficulty of the hyaline membrane, however, becomes more apparent than real when we remember that these structureless layers offer in reality very little true resistance to the passage of fluid, though they may occasionally exhibit the physical properties of semipermeable membranes. It is allowed, for example, that Descemet's membrane permits of the passage of certain diffusible drugs and toxins into the anterior chamber. It is quite probable that under normal conditions there is a fluid interchange through the hyaloid membrane between the retina and pecten. In some of my specimens the fibrillation of the vitreous appears to form definite radiating channels from the apex and sides of the pecten to all parts of the retina.

The situation and optical properties of the pecten must now be considered. Beauregarde has suggested that it might be of use in uniocular fixation to suppress the images seen in common by both eyes. In the first place one must consider the position of the pecten. This appears to be fairly constant in a wide range of classes of birds. The domestic hen is no exception to the general rule that the line of attachment of the pecten (i.e. the optic disc) runs from a point rather below the equator of the fundus and slightly to the temporal side of the mid-point of the posterior pole of the eye. From this situation the line of attachment runs downwards and to the nasal side, making an angle of between 60 and 70 degrees with the equator. From this line the pecten projects in a plane passing approximately through the centre of the lens. It thus lies very nearly in the plane of one of the secondary optic axes. As can be seen in the diagram in Fig. 5, practically all the rays of light in the eye which approach the pecten at all are passing in a plane parallel to or slightly diverging from it, and so they almost all strike its free border and very few fall on its sides. Hence, it will intercept very few rays and its shadow will fall along its own base or very slightly to one or other side, whatever the position of the source of light. The base of the pecten corresponds to the blind spot, so that the result of the presence of a pecten is merely a slight enlargement of the physiologically blind area found in all eyes at the entrance of the optic nerve. Furthermore, the pecten is always situated below the equator, hence the blind spot is always in the upper part of the field of vision, this being very little used in birds, which either seek their food on the ground or swoop on their prey from above.

The outline of the pecten seen from the side is variable, but always conforms to one of two types, (*a*) symmetrical and (*b*) larger in its lower part. Figs. 6 and 7 show examples (after Casey Wood) of these two types, the kestrel and the tawny owl being symmetrical and the cuckoo and the burrowing owl asymmetrical. Hence even in birds with very large pectens the increase of the physiologically blind area will be towards the upper or relatively unimportant part of the field of vision.

The macular arrangements of birds are variable and fall into six classes, according to Casey Wood, i.e.

1. The amacular type.
2. The nasal monomacular type.
3. The temporal monomacular type, chiefly in owls.
4. The bimacular type.
5. The infula-macular type, having one macula and a band-like central area of acute vision.
6. The infula-bimacular type, having two maculae joined by a band.

In all cases, except a few of those with infula-bimacular fundi, the maculae are above the upper end of the pecten and so arranged that in no position of the eye would the shadow of the pecten fall

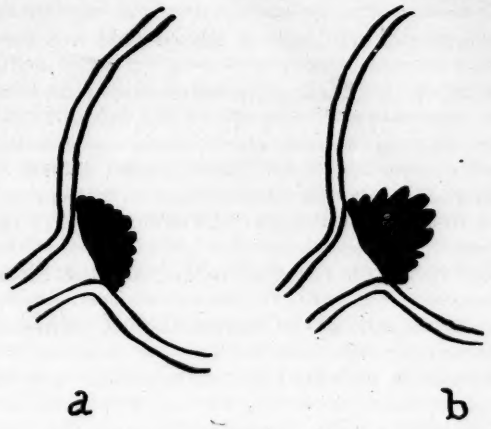


Fig. 6.

Symmetrical pectens. *a*. Kestrel. *b*. Tawny Owl (after Casey Wood).

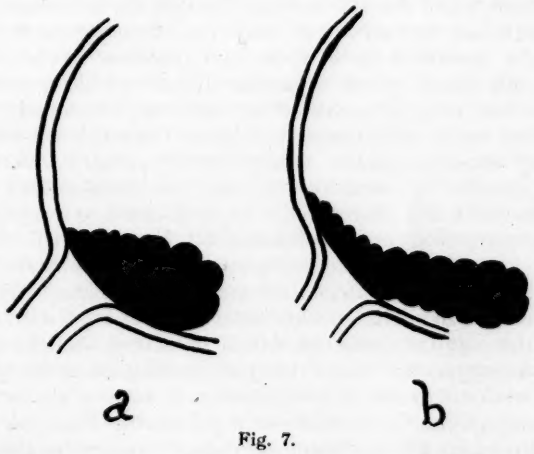


Fig. 7.

Asymmetrical pectens. *a*. Cuckoo. *b*. Burrowing Owl (after Casey Wood).

on either macula or the intervening retina. In some birds (e.g. flamingo) with a nasal and a temporal macula connected by a band, which also runs beyond the maculae, it will be found that

the temporal macula is lower than the nasal and that the temporal end of the band is considerably below the upper end of the pecten. Even in these cases, however, it can be seen by a consideration of Fig. 5 that the pecten will not interfere with the function of the band, since this latter is only used for rays of light coming from the upper and nasal side of the eye and it is these rays that either escape the pecten altogether or give rise to a slight shadow along its base only. These temporal maculae and bands are used to perceive objects in the nasal side of the field, i.e. in front of the bird, and it is these objects which are in some cases within the field of both eyes at once. The nasal macula is used for uniocular vision and this is always situated above the upper end of the pecten and to its nasal side, so that although rays of light from the upper temporal side throw a slight shadow on the nasal side of the base of the pecten this shadow will be below the nasal macula and will not interfere with it. Hence we may conclude that the pecten plays no part in the suppression of retinal images, but that on the contrary it is most excellently arranged so as to interfere as little as possible with the full function of any part of the retina. The dense pigmentation of the pecten serves, no doubt, to prevent any blurring of images by internal reflection.

The third point for consideration is concerned with the intraocular tension and the nutrition of the eye. It is, I think, obvious from what has already been said that the pecten, being non-contractile, cannot of itself produce an alteration in the intraocular tension, but that it serves to modify this seems likely. It is quite possible that, being in essence a large thin-walled venous reservoir, it allows of rapid displacement of blood from the eye and so cuts short any incipient rise of tension in the posterior chamber. A distinct parallel can be drawn between the intraocular circulation in the bird and the intracranial. In both one has a comparatively rigid box (cartilaginous sclerotic and bony skull) with small vascular foramina, semi-fluid contents and vessels devoid of vasomotor nerves. The analogy becomes more apparent also in view of the small size of the pecten arteries compared with the large area of the capillary network which they feed and the large size of the issuing pecten vein: this has its parallel in the small size of the cerebral arteries, the large area of venous sinuses and the large venous foramina in the base of the skull. The hydrodynamic possibilities of such a system have been studied in the skull by Cushing, Trotter and others, and they point out that the system serves very well to maintain a constant tension within the skull. The total volume of blood entering by the arteries in a given time must always (since the skull is a rigid closed box) equal the total outflow from the veins in that time, the difference of calibre in the

two sets of vessels only causing a difference in the rate of flow in the two sets and a rapid fall of blood pressure during the transit. Any increase of tension inside the skull will be met by compression of the veins and increased rate of venous outflow, so that for slight degrees of compression, short of causing reduction of the calibre of the veins below that of the arteries the intracranial tension remains normal, i.e. similar to the general venous blood pressure. A similar state of affairs probably holds good in the eye of the bird and any rôle played by the pecten in maintaining a constant intraocular tension is a passive one, depending on the circulatory condition of the eye as a hydrodynamic system.

With regard to the part played by the pecten in the nutrition of the retina, we have already shown that it possesses a structure suggestive of the power of selective secretion. If we consider the arrangement of the retinal blood supply in various classes of vertebrates we find that it is practically only in the lower mammals (e.g. *Echidna*) that there is no trace of intraocular vascularization apart from the choroid. Most of these animals are not remarkable for their acuity of vision or the high degree of development of their eyes or visual centres, the sense of smell being in them usually more important and elaborated. Of the remaining animals which show greater specialization in the direction of sight we can recognize two main types, those which possess a more or less complete system of retinal arteries and veins (similar to man and including most mammals and some amphibia, e.g. the horned toad) and those which possess some form of pecten and no retinal vessels proper (birds, lizards and some other Sauropsidans). Of these two classes the pectinate animals usually possess the greater visual acuity and the larger and more specialized eyes, often with most complex macular arrangements. Of the non-pectinate type man and the Anthropoids may be considered to have reached the greatest degree of development, very few of the other mammals possessing a true macula. The fact that a well developed pecten is never found in the same eye as an arteria centralis retinae in itself suggests that there may be some reciprocity of function between them. An attempt was made in this connection to show that both systems produced the same relative amount of blood supply, by estimating the ratio between the human retina and its vascular supply on the one hand and between the bird's retina and the pectinal vessels on the other. This is, of course, impossible to do directly and I was compelled to adopt a very rough method: by measurement and computation of serial sections of the hen's pecten the length of its vessels was ascertained approximately and a ratio was made between this and the total retinal area. The area of a full section of the retina of a six months' human foetus (injected with Indian ink) was calculated and the

length of the vessels therein ascertained as accurately as possible. The whole calculation is so rough that I have given neither an account of its working nor its formulae in this paper, but it is of interest to note that the two ratios separately obtained were 2.3 and 2.06 respectively, thus seeming to show that if the pecten vessels were unravelled and spread out a very fair imitation of a centralis retinae system would be obtained. It seems extremely probable that the visual acuity of an animal with a vascular retina can never equal that of a bird, since the presence of blood-vessels in front of the percipient layer interferes to an appreciable extent with the clearness of the image perceived. From this point of view then the pecten may be looked on as a modification of the intraocular vascular arrangements, having special reference in phylogeny to increase in the efficiency of the eye as an optical system without interfering with its metabolism by robbing it of any of its blood supply. This is in accord with the large size of the embryonic Sauropsidan eye, the importance of the visual centres and the various indications in reactions and mode of life which point to the tendency to specialization in the direction of the sense of sight rather than any other sense in these animals.

We have so far reached the conclusions that the pecten has a nutritive function, producing lymph for the metabolic needs of the retina, that it acts passively as a damper to combat any sudden changes in the intraocular tension and that it is so constructed as not to interfere with the development of a high degree of visual acuity. These conclusions are further supported by a consideration of the comparative development of the posterior pole of the eye, by means of which it can be shown that the pecten is the homologue of the arteria centralis retinae system.

I do not propose to go deeply into the matter of development as I have already dealt with it fully in this journal. The following points, however, deserve mention:

The development of both the pecten and the arteria centralis retinae is intimately connected with the choroidal fissure. If one takes two embryonic eyes, one of a mammal and one of a bird, both at the stage when the choroidal fissure is just beginning to close, one gets the conditions represented diagramatically in Fig. 8, *a*. and *b*. In both there is a blood-vessel (V) which runs from the posterior end of the fissure across the cavity of the optic cup to anastomose with vessels of the encircling mesoderm at the pupillary margin. In the mammalian eye (*a*) the lower portion of the optic cup is as large as the upper and the hyaloid vessel runs practically across the middle of the cavity and reaches the posterior pole of the lens. Here it breaks up to form the vascular capsule of the lens, some branches passing out of the extreme pupillary end of the cleft to anastomose with vessels outside the

cup. In the avian eye (*b*) on the other hand, the lower portion of the eye is very much smaller at this stage than the upper, the optic stalk being implanted quite low down on the posterior aspect, so that the hyaloid vessel entering at the top of the fissure only traverses the extreme lower part of the cavity of the cup and leaves again through the pupillary end of the cleft without having reached the lens at all.

As the eye in both cases increases in size there is a slightly more exuberant growth of the inner layer of the optic cup than of the outer at the posterior pole. This overgrowth of the inner layer leads to the formation of a slight heaping up and eversion of the inner layer along the upper part of the cleft. When the

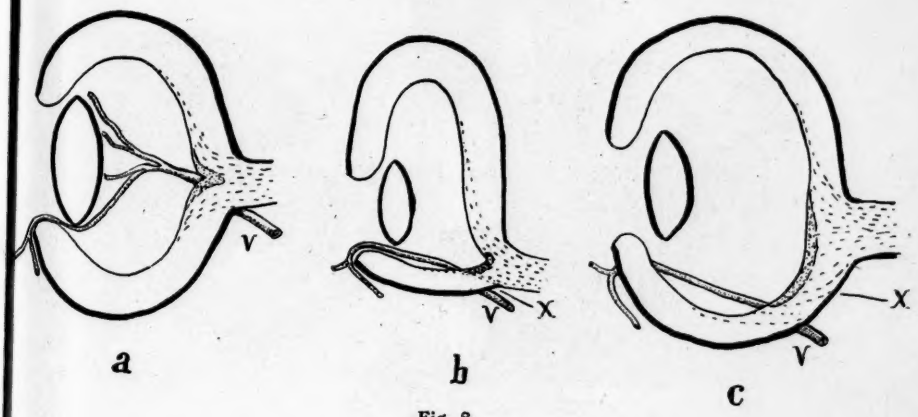


Fig. 8.

Diagram of hyaloid vessel. *a*. Embryonic mammal. *b* and *c*. Embryonic bird.

nerve fibres appear in the differentiating retina they make for this upper part of the cleft in order to reach the optic stalk, and in so doing cut off some of the cells of this ridge and leave them stranded on the vitreous surface of the nerve fibre layer. In mammals this only occurs at the extreme upper end of the fissure and the little mass of sequestered inner layer cells remains as a cone-shaped plug on the disc. Fig. 9 shows this plug (*p*) in a pig embryo. In birds, however, the increased rate of growth of the retinal areas bounding the upper end of the fissure is much more marked, since it is growth here which will eventually lead to the lower part of the eye equalling the upper in size. The area in which this growth occurs is marked *x* in Fig. 8 *b* and *c*. This growth of the upper end of the fissure leads to the displacement downwards of the original point of entry of the hyaloid vessel, which

appears to be more firmly attached at the pupillary end of its course, so that this vessel, not being held up by connection with the posterior pole of the lens, still only traverses the extreme

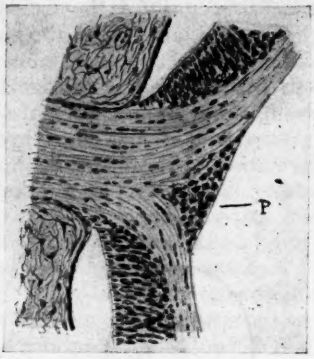


Fig. 9.

Optic disc of pig embryo P=epithelial cells on disc.

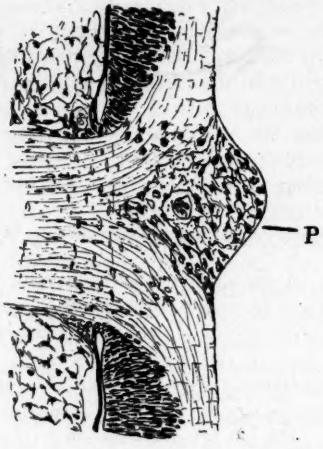
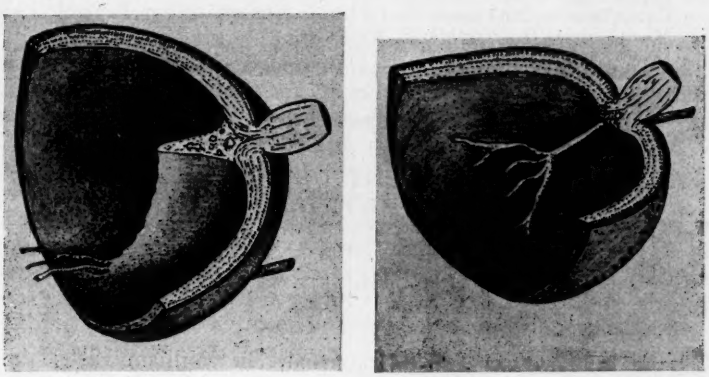


Fig. 10.

Developing pecten of chick. P=pecten.

lower part of the eye (Fig. 8 *c*). The process of sequestration of cells of the inner layer of the optic cup on the vitreous surface of the retina by the outward passing nerve fibres takes place in the bird over a much greater length of the fissure, and so leads to the

formation of a linear ridge and not a cone as in mammals. (See Fig. 10 of developing pecten for comparison with pig embryo in Fig. 9.) In both mammals and birds this mass of cells (in the one case a cone, in the other a ridge) becomes vascularized by a branch of the hyaloid vessel. In mammals the vessels in the mass of cells on the disc branch and spread over the whole surface of the retina in the nerve fibre layer as the *arteria centralis retinae* and its branches, while in birds they are confined to the ridge of cells, which increases in size and grows out into the vitreous as the *pecten*. Fig. 11 is a sketch of two models showing the early stages of the pecten ridge (*a*), and the vascularized cone of cells on the mammalian (human) disc (*b*). Thus we see that the arteria centralis



a *b*

Fig. 11.

Models of posterior pole of eye. *a*. Bird. *b*. Human (Diagrammatic).

retinae and the pecten both represent the vascularization, by a proximal branching of the hyaloid vessel, of a mass of inner layer cells cut off from the rest of the retina by outgrowing nerve fibres.

Conclusions

1. The main function of the pecten is the nutrition of the retina by means of fluid interchange through the vitreous network.

2. Morphologically the pecten corresponds with the retinal vessels of mammals.

3. The pecten exercises a beneficial effect on the eye by neutralizing passively any sudden changes in the intraocular tension.

4. Its peculiar form and arrangement are but one of the expressions of the high degree of specialization of the avian eye in the direction of increased efficiency as an optical instrument.

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A CASE OF RECURRENT DETACHMENT OF THE RETINA

BY

H. C. HIGHET, M. D.

WINCHESTER

IN the January issue of this journal, Sir William Lister deals exhaustively with holes in the retina and their relation to detachment, either of the sudden type or as a result of the presence of a new growth.

Towards the end of his most interesting communication he remarks: "Personally, I have seen no case in which there was a hole improve spontaneously or after treatment, and it is my opinion that with our present available methods such cases of detachment are practically hopeless." In order to supplement his own experience, he asks for further data with regard to the aetiology of holes in the retina, improvement in the clinical methods of detecting whether the retina is being pushed in by fluid from without or dragged in by adherent and contracting vitreous, and lastly for reports of the practical experience of surgeons in the treatment of these cases, classified according to their cause.

It is in reply to the third request that I venture to report a case of what I have entitled "Recurrent Detachment of the Retina," a case in which within five months three consecutive detachments were observed with apparent recovery.

The case is as follows:

On May 9, 1923, I was asked to see a lady, aged 61 years, who had suddenly gone blind in her left eye while sitting down to lunch during the previous day. There was no history of any injury to the eye or head, nor of any previous trouble with her eyes. There was no doubt, she told me, that the eye went wrong all at once. The only circumstance which might bear upon the aetiology was that she had been busy all the morning helping her maids in "spring-cleaning," and that she had assisted in moving the furniture. There was no pain in the eye which, on external examination, seemed to be in no way different from the right. Both pupils were equal as was also the tension. There was no circumcorneal injection, the cornea was free from any pathological condition and there was no tenderness on palpation. The eye, however, was totally blind without the slightest perception of light, and the ophthalmoscope failed to reveal even the faintest suspicion of any red reflex through the pupil. The radial pulse showed rather high arterial tension. A five per cent. solution of dionin drops was prescribed, and she was ordered to go to bed at once and to remain as much as possible flat on her back without a pillow under her head.

On May 16, a week later, she was seen at her own home when to my surprise she stated that her sight had come back. With her own glasses, +4D sph., she could read Snellen 1.5 with the left eye and 0.5 with the right. The ophthalmoscope showed nothing abnormal in cornea or lens, but there was a general haze of the vitreous with two large cob-web like floating opacities. The details of the fundus could not be made out and there was no evidence of retinal detachment.

Tension was still normal and the eye was free from pain.

The same treatment was continued, and on May 30, twenty-two days after the onset of the blindness, the general opacity of the vitreous had cleared up so well that the details of the fundus could be seen and nothing abnormal could be found. The large floating opacities in the vitreous were rather less but still quite evident.

She was now allowed to leave her bed for a few hours every afternoon and evening, was cautioned against any violent exertion, and was advised to spend most of her time downstairs lying on a couch.

I did not see her again until July 4, when she came to me in a very despondent mood. Her story was that until June 23 her eye had improved steadily, but that suddenly on that day it had gone wrong again. At first the lower part of the field became blind and gradually the blindness became general, but some sight had come back within the last few days. On examination an absolute scotoma was found in the lower half of the field, and corresponding

to this a detachment was discovered involving nearly the whole upper half of the retina. She was ordered to bed again, a pad and bandage were applied to the eye, and the dionin drops were prescribed again.

Three weeks later, on July 25, I noted that the detachment had disappeared, but that owing to the general fine haze in the vitreous the exact details of the fundus could not be clearly made out.

On September 5, rather less than four months after the onset of the initial detachment and rather less than two and a half months after the onset of the second detachment, a third detachment appeared just as suddenly as the others, but this time in the lower half of the retina only. It followed the same course as the others and by October 10, I was able to report that the detachment had completely righted itself. There was still considerable haze in the vitreous and visual acuity amounted to 6/36 unaided and Snellen 2.5 with her glasses.

She was last seen on January 30, 1924, rather more than three and a half months after the third detachment was noted as having disappeared. The vitreous was now found to be quite clear, even the large cob-web opacities having gone, and the details of the fundus could clearly be made out. No trace of detachment was visible, and in fact, with the exception that the optic disc in the left eye seemed to be rather paler than its fellow in the right eye, nothing abnormal could be seen. Arteries and veins seemed normal and there were no signs of choroidal or retinal disturbance. Having already read Sir William Lister's communication I made a very careful search for holes in the retina but could discover none. Visual acuity now was reduced to 6/60 with difficulty, owing to the distortion of objects which seemed broken in pieces.

In spite of the fact that no hole has as yet been detected in this case, the history of three consecutive detachments and the evident fluid character of the vitreous entitle us to infer the presence of a hole in the retina.

The aetiology is obscure. The patient is a healthy married woman, nearly 62 years of age, and the mother of a large family all now grown up and healthy. She has always enjoyed good health and the urine is free from albumen or sugar. It was impossible to get a Wassermann test, but I am confident that it would have proven negative. Refraction of both eyes gives +1D sph. The presence of a new growth may be excluded.

Treatment consisted simply of rest in bed, the application of a light pad and bandage and the instillation of a five per cent. solution of dionin.

The prognosis is uncertain, but whether it is as hopeless as Sir William Lister makes out only time will tell.

PRESCRIBING SPECTACLES

BY

A. S. PERCIVAL

NEWCASTLE-UPON-TYNE

FROM time to time there is an outcry by ophthalmologists against the prescribing optician, but it must be noted that the opticians generally have raised their standard, and those in the first rank know more about optics than we ophthalmologists as a class do. It is only when we have shown by our work that we are better at prescribing spectacles than the best optician that we can regain our leading position at refraction work.

It is not the estimation of the refractive error that is so frequently at fault, but attention to little details in the prescription that I wish to speak about now.

A fortnight ago a patient complained of her reading glasses, she had taken them back to the well-known ophthalmologist who prescribed them, but after examination he pronounced them to be all right, and said that she must learn to use them. I found that the refractive error and the presbyopia were quite accurately corrected (R +2D, L +5D), each glass, moreover, was normally centred, and these centres were opposite her pupils in the primary position. But when reading she depressed her eyes 14° of 15°, and consequently her fixation lines traversed her lenses about 7 mm. below their centres. (For the centre of rotation of the eye is situated about 27 mm. behind the first focal plane of the eye, the situation of the spectacles, and 27 tan $14\frac{1}{2}^{\circ}=7$ mm.) Hence the line of print she was reading was depressed $\frac{Dl}{10}$ or $\frac{2\times 7}{10}$ or 1.4 $\bigtriangledown$ for her right eye and $\frac{5\times 7}{10}$ or 3.5 $\bigtriangledown$ for her left eye. In other words when reading she suffered from a right hyperphoria of 2.1 $\bigtriangledown$ induced by her spectacles. Either the glasses should be lowered by raising the bridge 7 mm. so that the fixation lines should pass through the optical centres of each glass, or better the left glass should be decentred down 4 mm. according to the well-known formula $l=\frac{10\,N}{D}$ or $\frac{21}{5}$. It would be foolish to order a decentration of 4.2 mm. as this would entail much needless labour and expense. This alteration in her left glass relieved her of all her previous trouble. But what I want to insist upon is this, that the ophthalmologist should have noted this point about the decentration on his prescription; it is not good for his reputation, which he has deservedly won as a most accomplished and successful operator.

It will be found that attention must be paid to decentration in all reading spectacles for anisometropes. But do not correct a heterophoria that does not give rise to any symptoms; in fact only order a correction if it is found on trial to give relief. Enough about decentration; I dealt thoroughly with the subject in 1921 (*Brit. Jl. Ophthal.* Vol. V., pp. 453-9).

Some thoughtful attention should be devoted to the subject of periscopic effect. For instance, should +3D sph. -6D cyl. ax. 180° or -3D sph. +6D cyl. ax. 90° be prescribed? In the first case when the cylinder is placed next the eye it must be remembered that the plane axis is horizontal, and as the periscopic effect is most desired in the horizontal direction, the second form with the concave spherical next the eye is far the better. Had the axis of the cylinder been against the rule say +3D sph. -6D cyl. ax. 90°, this form would be the best with the cylindrical surface facing the eye; for now a concave surface of -6D in the horizontal direction would be next the eye.

Periscopic lenses are fairly easy to order if there is no astigmatism, but when astigmatism is present toric surfaces must be ordered, and as toric surfaces are only ground on a 3D, 6D or a 9D base (positive or negative) much ingenuity will be required in getting the best possible result.

For large convex menisci 41 mm. in width and 1.2 mm. thick at the edge ($\mu = 1.523$), it is well to remember that very satisfactory periscopic lenses can be made for *close work* with the concave surface of -5.5D facing the eye between the powers of +4D and +8D. Indeed, within these limits the eye can range throughout a solid angle of 60°, i.e. 30° in any direction from the middle line and have perfect sight, the radius of the circle of confusion being less than that of a macular cone.

For accurate work one must remember that with a convex meniscus the second principal point is in front of the lens, so that the *back focal distance* (B.F.D.), measured from the axial point on the concave surface in the anterior focal plane of the eye, is rather less than the actual focal length of the lens. For instance, a periscopic lens of axial thickness 4.5 mm. with anterior surface +12.5D, posterior surface -5.5D will have the effect of a +7.5D lens (not a +7D lens), for its B.F.D. is -133.7 mm. As the concave surface next the eye and so f_2'' are known, and t the thickness of the meniscus for a given strength is also known, one puts B.F.D. equal to the second focal distance of the lens required, and the value of the convex surface can be found from the formula

$$\text{B.F.D.} = \frac{f_2''\ (t+f_1'')}{t+f_1''-f_2'}$$

These glasses will not be periscopic for distance; I find that between the range of +6D and +9D the ocular concavity must be that of a -7D lens.

As an example, suppose a periscopic lens of +6D be required for distance, the power of the ocular curvature will be −7D if $\mu=1.523$, and $t=3.8$ mm., what will be the power of the anterior surface?

$$\text{BFD} = \frac{f_2''\,(t+f_1)}{t+f_1''-f_2'} = \frac{f_2''\,x}{x+\mu f_2''}$$

When $x=t+f_1''$, and f_1'' must be found

We have $\frac{1}{\text{BFD}} = \frac{1}{f_2''} + \frac{\mu}{x}$

or if D represents the power required (+6.5) and if d denote the power of the ocular curvature $(-7)\ -.001\ (\text{D}) = -.001\ (d) + \frac{\mu}{x}$

$$\text{or } x = \frac{-\mu}{.001\ (\text{D}-d)}$$

This is the general formula; in this case

$$x = \frac{-1.523}{.001\ (6+7)} = \frac{-1523}{13} = -117.154 = 3.8 + f_1'' \quad \therefore f_1'' = -120.954$$

and the power of the anterior surface should be $\frac{-1000\,\mu}{f_1''} = \frac{1523}{120.954} = +12.59\text{D}.$

From an examination of the much advertised Punctal lenses I find that the refractive error as well as the astigmatic error is far greater in the peripheral part of the field than in my pattern.

In conclusion I may briefly give the method of converting a sphero-cylinder into toric form, as it is rarely given in the books. I should point out that the method makes no correction for the position of the second principal point, so the result is not mathematically accurate.

Prescribing Toric Lenses. Write the sphero-cylinder as two crossed cylinders. Thus if the sphero-cylinder be +3.5D sph. +3.5D cyl. ax. 90° write it as +3.5D cyl. ax. 180° and +7D cyl. ax. 90°. Call the lower cylinder L, and the higher cylinder H.

(I) Compound Astigmatism

(1) When the base is of the same sign as that of the cylinders

Subtract the value L of the lower cylinder from the base and denote the result by A, or A=B−L.

Add A+L and the result is one cylinder, in fact the base.

Add A to H and the result is the other cylinder for the toric surface.

The spherical surface is given by −A.

For instance, suppose the given sphero-cylinder for reading be +3.5 sph. +3.5D cyl. ax. 90° or +3.5D cyl. ax. 180° and +7D cyl. ax. 90°.

It will then be found that the best result will be obtained on a +9D base.

Then A = B - L = 9 - 3.5 = 5.5.

A + L = 5.5 + 3.5 = +9D cyl. ax. 180°.

A + H = 5.5 + 7 = +12.5D cyl. ax. 90°.

The prescription is written thus:—

$$\frac{-5.5\text{D sph.}}{+9\text{D cyl. ax. } 180^\circ \text{ and } +12.5\text{D cyl. ax. } 90^\circ}$$

As noted above this will give an excellent periscopic result if the glass is only required for close work.

(2) When the base is of opposite sign to that of the cylinders let A = B - H, and then proceed as before.

Suppose that we wish to write the same sphero-cylinder in toric form on a -6D base.

A = B - H = -6 - 7 = -13.

A + H = -13 + 7 = -6D cyl. ax. 90°.

A + L = -13 + 3.5 = -9.5D cyl. ax. 180°.

and we obtain $\frac{+13\text{D sph.}}{-6\text{D cyl. ax. } 90^\circ \text{ and } -9.5\text{D cyl. ax. } 180^\circ}$

This would be a better periscopic form than the first one for distance.

(II) Mixed Astigmatism

Take the difference between the base and the value of that cylinder which is of opposite sign and call it A.

Suppose that we write -1D sph. +3D cyl. ax. 90°, or -1D cyl. ax. 180° and +2D cyl. ax. 90°, in toric form on a +3D base

Then A = 3 - (-1) = 4.

4 - 1 = +3D cyl. ax. 180°, and 4 + 2 = +6D cyl. ax. 90° and the prescription is

$$\frac{-4\text{D sph.}}{+3\text{D cyl. ax. } 180^\circ \text{ and } +6\text{D cyl. ax. } 90^\circ}$$

This would be the best periscopic form for this glass with the present available toric lenses, but there would be a very fair periscopic range even without using torics at all, i.e. with the -1D curvature facing the eye and the +3D cylinder anterior.

What I protest about is the not uncommon practice of the ophthalmologist baldly giving the sphero-cylinder which corrects the error of refraction and then adding "give periscopic form." It is only comparable to a doctor writing instead of a prescription to a chemist "give something for rheumatism."

Finally, there is a warning I should add; some few cases cannot wear periscopic lenses, they complain of the surface that they look at appearing curved: I have not yet got to the root of this trouble. Most patients who have once worn periscopic lenses will never be content with the simple correction again. However, for lenses of low power there is no necessity to order the periscopic form.

COUNCIL OF BRITISH OPHTHALMOLOGISTS

Report on the Institutional Treatment of Interstitial Keratitis

IN the Report of the Departmental Committee on the Causes and Prevention of Blindness, 1922, under the heading "Syphilis," it is stated that the Board of Education furnished a table concerning 1,036 blind children of whom 12.9 per cent. had lost their sight from interstitial keratitis. In an analysis by Mr. Bishop Harman of 1,855 blind children 399 (21.5 per cent.) certain, were classed as cases of interstitial keratitis, in 359 of which there was evidence of syphilis.

In Liverpool Mr. Bickerton reported that out of 173 blind adults there were 11 cases of interstitial keratitis.

In Bristol Dr. Fells found amongst 84 blind adults 6 cases of loss of sight from that disease.

Mr. Bishop Harman in an analysis of the causes of blindness in 601 persons of all ages reported 28 cases of interstitial keratitis, 24 of which were due to syphilis.

With regard to the incidence of interstitial keratitis among other eye patients, exact statistics are wanting; but Mr. Holmes Spicer, from such figures as he was able to gather, estimated it at 0.6 per cent., while Mr. Sydney Stephenson put the number at not more than 1 per cent.

Interstitial keratitis is a disease which occurs usually in children the subjects of congenital syphilis. It runs a definite course, the average duration of active inflammatory symptoms lasting four months, whilst the resolution of the disease may be postponed for months or even years. In the course of the affection the vision becomes considerably impaired, owing to the cornea becoming like ground glass. Though up to the present it has been found impossible to cut short an attack, the severity of the symptoms and the amount of sight which is ultimately regained can be largely influenced by local and general treatment. When permanent blindness results from the disease it is usually due to neglect in treatment or the impoverished state of the general health of the patient.

At the present time cases occurring in Poor Law Institutions are transferred to Infirmaries in London where there is not the possibility of that open-air treatment which is so essential if the best results are to be obtained.

Cases occurring amongst London County Council School children are mostly treated at the voluntary hospitals. The large majority receive only such treatment as can be given to out-patients, which means that the treatment prescribed for application to the eyes has to be carried out by the patients' relations or

friends, and that during the course of the attack they remain in their own, often overcrowded, homes receiving inadequate or unsuitable nourishment for such a condition. A few may for a time be admitted as in-patients, but the accommodation available in these institutions does not permit their being kept in during the active stage of the disease.

The great benefit which is derived from fresh air, healthy surroundings and skilfully applied local treatment in corneal affections is seen at the Metropolitan Asylums Board White Oak Ophthalmia School, Swanley. Children admitted there with phlyctenular keratitis, who have been attending for months at an out-patient department without any signs of improvement, rapidly recover in the altered environment.

From time to time medical officers at the Poor Law Infirmaries send cases of interstitial keratitis for admission to the White Oak Ophthalmia School, but as at the present time that school is reserved strictly for contagious ophthalmia, they have to be refused admission.

Since the establishment of the Metropolitan Asylums Board Ophthalmia Schools the amount of ophthalmia in the Poor Law Schools has so greatly decreased that the Brentwood School has been entirely handed over for other purposes. At Swanley School, though the main part of the accommodation is still used for ophthalmic cases, one block of twelve cottages containing 72 beds is cut off from the rest of the establishment and utilized for convalescent children not suffering from any eye affection. This block of cottages at Swanley School situated in the grounds of the Ophthalmia School but isolated from the rest of it, and originally constructed for the accommodation of children suffering from eye diseases, would make an excellent department for the institutional treatment of Poor Law and other children suffering from interstitial keratitis.

If so employed there can be little doubt that the amount of impaired sight and blindness from this disease would be materially diminished.

ANNOTATIONS

The use of Synchronously Intermittent Light in Industry

At the annual meeting of the Illuminating Engineering Society last year a paper was read by Dr. J. F. Crowley on some recent developments in connection with the observation of moving objects made possible by the neon lamp. This lamp consists of a bulb

from which the air has been exhausted and into which a small quantity of neon gas has been admitted. The current passes by discharge between two electrodes within the bulb, and consequently, as the heat capacity of the rarefied gas is practically negligible, it lights up and darkens to all intents and purposes instantaneously as the current is switched on and off. It is stated that as many as 10,000 distinct flashes per second can be obtained. A strong and efficient instrument has now been constructed to work with this lamp, the details of which will be found in the account of Dr. Crowley's paper in the *Illuminating Engineer*, Aug.-Sept., 1923. On the occasion of his lecture Dr. Crowley applied this apparatus to the study of the motions of the sewing machine. The vertical driving rods could be caused to appear at rest or moving very slowly, and the number marked on a small lever, actually in rapid vibration, could be read with ease. Mr. Leon Gaster in his comments on the lecture points out that the device places a new weapon in the hands of the student of mechanics. It enables the operator actually to observe machinery in rapid movement as if it were stationtary, and so to recognize and correct defective action before it has revealed itself by spoilt work. The phenomenon of "persistence of vision," on which the instrument depends is also utilized to a certain extent in the kinematograph with, however, the important difference that with the oscilloscope the movements are seen while actually taking place and not, as with the kinematograph, recorded afterwards. A photograph of a milling cutter revolving at 125 revolutions per minute with a cam revolving at 250 revolutions per minute, together with a photograph of the same apparatus at rest, the former being taken by the light of the oscilloscope lamp, is used to illustrate the paper. Mr. Gaster points out that many other mechanical problems hitherto only treated theoretically, such as the whirling of shafts, the vibrations of unbalanced machinery, and the results of inaccurately fitting bearings, may be studied with the help of such apparatus from a more practical standpoint.

The Middlemore Lecture, 1923

This annual lecture was delivered last year by Mr. N. C. Ridley of Leicester, on ophthalmology and general practice, with the evolution of the former, and was published in the *Midland Medical Journal*.

It is good for the ophthalmic surgeon to unbend at times, to change from his scientific or clinical outlook and to wander for a few moments into the bypaths of the history of his subject. The origin of ophthalmology is hidden in the mists of remote antiquity :

probably, as Mr. Ridley says, the demand for eye doctors created the supply. We know how large a part diseases of the eye formed in all the old treatises and it needs no very deep knowledge of the Bible to be aware of the fact that blindness is often referred to, while everyone remembers the miraculous restoration of sight recorded in the New Testament, where the miracle "was probably chosen as unassailable evidence of supreme power over evil, for it would be looked upon as almost as great a thing as the raising of the dead."

The legitimate practitioner and the quack must have arisen almost simultaneously; they grew up side by side and they are flourishing to-day. Mr. Ridley's fascinating lecture dealt with many subjects of interest, ranging from the evil eye, Greco-Roman medicaments and ophthalmology 200 years ago to spectacles, opticians and the ophthalmoscope, fees and the general practitioner, and it was illustrated by 27 lantern slides. With such a wealth of material on which to draw, it is not surprising that the lecture is not only valuable to the archaeologist but also extremely interesting to the ordinary medical mind. We have not sufficient space in which to abstract it fully, but we may be pardoned if we attempt to elaborate a little one of the many subjects on which the author touched, that of the Roman oculist's stamps.

It is a remarkable thing that so many of these have been discovered, not only on the Continent, but even in the outlying province of Britain. Hardly a Roman site of any importance that has been excavated during the last century but has yielded one of these objects, and the names engraved on them are never the same. Mr. Ridley mentions the one in the Leicester (Ratae) Museum which was the property of Gaius (should this be Caius?) Pal Gracilis, but there are many others, such as the Kenchester (Magna) stamp, the Wroxeter (Viroconium) stamp found in 1808, that found at Cirencester (Corinium) which belonged to Minervalis, that of Titus Junianus of Bath (Aquae Solis) found in 1731 and, among others, that found at Gloucester (Glevum).

These stamps are usually square or rectangular blocks of stone with the inscription cut on the edges, but two, the Leicester and Wroxeter stamps are circular, and in the case of the latter, the inscription is cut on the face; they were doubtless used to impress the maker's name and the directions for use on the ointment, much as the maker's name is impressed on the modern cake of soap. For the most part the Roman collyrium or dialebanum was described as a specific for all diseases of the eyes, to be used "ex ovo," with egg, but at times more precise information was given, such as "ad claritatem," for clearness of vision; the golden collyrium for clearness of vision; for old cicatrices, and the dialebanum against blear eye "lippitudo, etc."

We hope that Mr. Ridley's scholarly article will be read by all ophthalmic surgeons; Middlemore himself was keenly interested in the history of medicine, and it is a subject that none of us can afford to overlook.

ABSTRACTS

I.—PERIMETRY AND VISUAL FIELDS

Hill, Emory.—Cases of bitemporal contraction of the visual fields. *Amer. Jl. of Ophthal.*, Vol. VI, No. 4, April, 1923.

The author contributes a paper based on forty cases seen in the past three years, which presented fields indicating pressure on the chiasma. He discusses the cases under the following headings: Hypopituitarism; recurrent convulsions with hypopituitarism; pituitary headache; pituitary disturbances in relation to infections; hyperpituitarism; cerebral syphilis; hydrocephalus, and tumours. Under pituitary headache, he points out that such cases are for the most part hypopituitarism, with headache as the most conspicuous symptom: the headache is deep seated in the temporal regions. His cases of hypopituitarism, twenty-seven in number, gave a history of headache in seventeen; nine of these confessed to bitemporal pains, and of the nine, six had epileptiform attacks and in three of these six the attacks were associated with severe bitemporal pains. Such cases have slight bitemporal contraction of the fields, with the characteristic upper temporal slants. Three illustrative cases of pituitary headache are described.

In his conclusions, the author dwells on the value of perimetry in the early diagnosis of slighter disorders situated in the region of the chiasma, and on the secondary effects caused by hydrocephalus. Large test objects are useless to bring out the finer changes in the fields; the use of very small white or coloured test objects is urged; these often reveal tendencies towards bitemporal hemianopia. Enlargements of the blind spots, relative scotomata in the upper temporal quadrants and blurred temporal peripheries in which a large white disc is not recognised as white, but merely as a moving object have been specially frequent in his series of cases and these deserve special mention as precursors of temporal hemianopia.

R. R. J.

II.—WOUNDS AND INJURIES

(1) **Brunetière and Amalric.—Severe haemorrhage following an extensive wound of the sclera. Suture of the scleral wound. Cure in the functional sense. (Hémorragie grave consécutive a une plaie étendue de la sclérotique. Suture de la plaie sclérale. Güerison fonctionelle.)** *La Clin. Ophtal.*, May, 1917.

(1) **Brunetière** and **Amalric** record a case which must be rare. A soldier was struck on the left eye and eyelid by a piece of a gun-tube. The piece of metal was removed at a general hospital by a careful surgeon who was particular to cause as little further traumatism as possible. It is not stated from where exactly the foreign body was removed. At any rate there was very free haemorrhage and both lids were much ecchymosed. The piece of metal was 1.5 cm. long and weighed approximately 2 grammes. Very fortunately it was decided to leave the question of enucleation of the eye to the specialist.

When seen at the special hospital it was found that there was arterial haemorrhage which did not yield to pressure or to hot irrigations with alcoholized water. Nevertheless there was some vision. The tension seemed to be diminished but was difficult to estimate owing to the condition of the lids.

Under chloroform the scleral wound was found to be about 10mm. in length, sharp and clean, and extending from near the limbus nasally in a horizontal direction, towards the caruncle. There was no escape of vitreous and the authors concluded that the deeper membranes were not involved in the lesion. Blood was escaping freely from the wound. The bulbar conjunctiva having been excised on each side two very fine silk sutures were passed through the superficial layers of the sclera. Haemorrhage ceased at once, a compress was applied and the patient put to bed. The bleeding returned very soon, less abundantly, however, and at the end of an hour again ceased. The question of enucleation was then finally put aside. The subsequent history was uneventful. Some days (exact number impossible to determine from the context) after operation the deep sutures were removed, and the conjunctiva, having been freshened, was sutured over the wound. Vision improved to 1/3 before the patient was evacuated. The fundus could be seen but not very distinctly owing to some vitreous opacity. Nothing to suggest retinal detachment. A month or two later reports indicated that the tension was normal, the vision 4/10, no choroidal or retinal lesion visible, though there were still a few flakes in the vitreous. The authors conclude that the very abundant haemorrhage came from the long posterior ciliary arteries, which

had been cut clean by the sharp clean fragment. The case is undoubtedly a fortunate one, doubly so in that primary enucleation was not practised, and in that it was throughout skilfully treated.

ERNEST THOMSON.

(2) **Terrien, F., and Cousin, G.—Wounds of the Eyeball by Grenade Splinters. New Model of Protective Mask. (Blessures du Globe par Éclats de Grenade. Nouveau modèle de masque Pare-Éclats.)** *Arch. d'Ophtal.*, May-June, 1918.

(2) In an earlier communication* **Terrien** and **Cousin** published some figures illustrative of the gravity of wounds of the eyeball. Of 561 soldiers admitted to hospital for wounds of the eyeball from all varieties of missiles, shell fragments, bullets, grenades, etc., they found that in 60 per cent. almost complete loss of vision resulted, and in 40 per cent. a visual acuity of no more than 1/10 was retained. de Lapersonne† in a paper on the same subject has drawn attention to the frequency and gravity of small wounds of the eye received in war. Since these notes were published, trench warfare, without lessening the frequency of ocular lesions had led to a greater proportion of wounds by grenade splinters. The authors have tabulated the cases of wounds of the eye from this cause, seen at the IX Ophthalmic Centre, during a period of 18 months.

Of 452 wounds by splinters, 116 were caused by exploding grenades, and 326 by shells. The splinters from the latter are generally small. Of the 116 cases of grenade wounds, the results as to vision were:

Complete loss of vision	70
Vision reduced to perception of light ...	33
„ better than 1/10	13

These figures, especially when compared with those given at the beginning of this article indicate the seriousness of wounds of this kind, leading to loss of useful sight in as many as 89 per cent. of the cases.

The penetrating particles are generally so minute that they are not discoverable by radiography, and are often very difficult to find in an eye which has been excised.

J. B. LAWFORD.

(3) **Posey, Wm. Campbell (Philadelphia).—Injury to the eyes from lightning stroke.** *Amer. Jl. of Ophthal.*, Series 3, Vol. 1, No. 2, Feb. 1918.

(3) **Posey** relates two cases of eye injury from lightning. In the first one the lens was observed from the very beginning (by

* *Arch. d'Ophtal.*, p. 811, 1915. † *Arch. d'Ophtal.*, p. 129, 196.

another practitioner) gradually to become opaque, the opacification first appearing as a faint scratch on the posterior capsule. Four months later a needling was performed by Posey, but the result is not known at the time of writing. In the second case (also seen in the first instance by another practitioner) there was smarting and burning of the eyes, lacrimation, blepharospasm, injection of conjunctiva, contraction of pupils, while vision was reduced to hand movements at a few inches. At this date ophthalmoscopic examination was very difficult, but so far as could be seen the media were clear and optic discs normal. Cerebration was impaired and there were choreiform movements of left arm and hand. When seen by Posey a few days later the choreiform movements had ceased and cerebration had cleared. The right visual acuity was merely light perception and the left, hand movements. The blepharospasm having yielded and the pupils being dilated by the use of atropin it was found that there was a diffuse haze of both retinae with oedema. There were no haemorrhages or extravasations and the lenses were clear. Strychnine, which had already formed part of the treatment, was continued. Vision progressively improved till, after a little more than a month from the injury, it was normal and the field unrestricted. Posey next considers the literature, which is scanty, and finds that the majority of reporters cite some disturbance to the lens, and this varying from localized opacities to fully developed cataracts. There have been various theories to account for the lens affection, for example, direct physico-chemical action upon the lens substance (Leber); rupture of the capsule (Yvert); direct burn of the lens (Knies); and the theory of Hess. Hess considers that the opacities of the lens and atrophy of the optic nerves are produced, not like the external injuries by the action of heat, but by the power possessed by the electric discharge to kill living cells even without the development of heat: the lens epithelium is killed. Posey points out that owing to the possibility of fundus damage the prognosis as to the results of operation for lightning stroke cataracts must be very guarded. Needling appears to be the operation of choice, and nothing should be done until every trace of ciliary irritation has subsided.

ERNEST THOMSON.

(4) **Beauvieux (Bordeaux).—Bilateral traumatic rupture of the Sclera. (Rupture traumatique bilatérale de la Sclérotique.)** *Arch. d'Ophtal.*, Sept.-Oct., 1919.

(4) Ruptures of the sclera resulting from non-penetrating wounds in battle have been quite exceptional. **Beauvieux** has seen only the case now reported. **Lagrange** draws special attention to their rarity.

Beauvieux's patient was one of thirty men in a dug-out, about 500 metres behind the front line. A 105-shell penetrated the roof of the shelter and burst about 2 metres from him, to his right and a little behind. The man, who was seated at the time, fell over on his left side, felt as if violently slapped on the face, and became blind immediately. The right eye showed a long crescentic subconjunctival rupture of the sclera in the ciliary zone above and to the nasal side of the cornea; this eye had no perception of light. The left eye was similarly but more extensively ruptured, two-thirds of the circumference being involved in two nearly continuous lacerations. This eye retained perception of light. The author is of opinion that the bilateral ruptures in his case are best explained as a result of air-concussion due to an enormous and sudden alteration in atmospheric pressure caused by the explosion of a projectile of large calibre at a short distance, and in a limited space.

J. B. LAWFORD.

(5) **Bramley-Moore, A. A. (Edmonton).—Injuries to the Eyes from Broken Glass.** *Canadian Med. Assoc. Jl.*, Dec., 1923.

(5) **Bramley-Moore** considers that minor injuries to the eyelids from broken spectacles are fairly common, and that injuries to the eye itself are more common than a perusal of the literature would suggest. In the last eleven years in Montreal he has had eight cases of injury to the eye from broken spectacles, and in one case the eye had to be removed. In two cases prolapsed iris had to be excised, in three cases the injury was not dangerous. In five of the cases, defective vision was present. One was in a child with strabismus. One case had high myopia. One case had an amblyopic eye and the good eye was injured, losing the lens. Four of the cases were wearing spectacles and four eyeglasses. The author states that eyeglasses are much more easily dislodged than spectacles and narrates an accident that happened to himself when he was struck by a baseball on its first bounce which came with great velocity, striking the outer edge of his eyeglasses and the outer edge of the upper orbital ridge. The glasses were torn off and thrown some feet, but were not broken and his eye was undamaged. In a second accident while smashing wood on a camping trip, a piece flew up and struck the outer edge of his spectacles a severe blow. The side struck broke off at the nose-piece and disappeared in fragments, while the remainder of the spectacles kept in position and his eye was undamaged. Eyeglasses are probably safer than spectacles, but are rarely suitable for children. In the case of adults working as machinists glasses are a great protection and for those working on emery wheels they are indispensable; in Canada, it is against the law to work on an emery wheel without a pair of

protective goggles. It is a great pity that some law of this sort is not put in operation in this country. The author makes no mention of the advantage of lenses ground in triplex glass.

R. R. J.

III.—MISCELLANEOUS

(1) **Heuer, G. J. (Cincinnati).—Traumatic Asphyxia; with especial reference to its ocular and visual disturbances.** *Surgery, Gynecology and Obstetrics.* May, 1923.

(1) This is a long paper with a full bibliography; it is founded on a case in France in 1917 which was under the care of the author. A sergeant was crushed beneath an overturned motor truck and suffered a violent compression injury of the lower part of the chest and of the abdomen. On admission to the Base Hospital he was conscious and answered questions intelligently. The face was markedly oedematous and of a deep violet colour; this discoloration extended up to the line of the hair, involved the ears and neck and extended over the upper part of the thorax, where, however, it was less marked. Upon this violet background were many petechial haemorrhages. The eyes were closed and could not be opened voluntarily, due to oedema of the lids. On separating the lids a complete bilateral subconjunctival ecchymosis was seen. The lips were swollen and blue-black, the mucosa of the tongue and mouth and the external auditory meatus showed the same discoloration.

There was no serious thoracic injury present, but the pubis was fractured and the bladder was distended with blood. The rent in the wall of the bladder was sewn up and the wound of operation in the anterior wall of the viscus was closed without drainage, extravesical tamponade was used to control the bleeding, and the fractured pelvis was firmly strapped. Recovery was uneventful, but when the oedema of the lids had cleared up the man found that he could not see. The ophthalmoscope showed a bilateral retinal oedema and massive haemorrhages scattered over each disc and macular region. The patient eventually became quite blind, the fundus showing optic atrophy with attenuation of the vessels. More than two years later the man called on Heuer in Baltimore; he had been trained at a school for the blind and had become a skilful masseur.

Heuer reviews the literature of this subject touching on the general side of it, but going into detail with regard to the ocular manifestations and visual disturbances.

This injury is always due to a severe compression of the thorax or abdomen or both together; the name is derived from the characteristic discoloration of the face and neck; at first sight this appears uniform but close inspection shows that the blue-black background is studded with small petechial haemorrhages. The livid tint fades away over the upper part of the abdomen and is strikingly absent at points of pressure, such as where the collar band or hat brim has been situated. The colour fades away usually in a couple of weeks and does not behave like an ordinary bruise. Subconjunctival ecchymosis has been noticed in nearly every case, these show the usual chromatic changes as they clear up. Bodily injuries are usually severe and may be of any nature from fracture of the bones to rupture of the lung or of an abdominal organ, and injuries to the cord or peripheral nerves.

Many of the reported cases having terminated fatally, examination of sections of the skin has been occasionally undertaken, and, as a general rule, the sections have not shown any marked extravasation of blood into the dermis, and the idea is favoured that the livid colour is due not to extravasation of blood but to venous stasis with paralysis of the vessel walls. Some experimental work has been done by Vogt and Perthes on rabbits and this is referred to in the article. As regards treatment, venesection is indicated, and as regards mortality, of the 127 cases included by the author in his paper, 27 died almost at once from the severity of the injury; of the 100 cases which survived the initial injury, 92 recovered and 8 died.

With regard to the ocular complications, it has been frequently noted that retinal haemorrhages are rare. In this series, subjective visual disturbances were found in 16 cases in all; three other cases complained of failing vision at a later date; these 19 cases are briefly abstracted. In 53 of the cases in this report no mention is made of any visual failure, in 21 cases it is definitely stated that there were no visual disturbances. In six cases the loss of vision was immediate but the return was very rapid; in eight cases impairment of vision in one or both eyes was immediate, and in all but one permament. In three cases there was no immediate loss, but subsequent impairment resulted. As far as the records go impairment or loss of vision has in the majority of cases been associated with retinal haemorrhage; five cases show that exceptions to this rule occur. Orbital haemorrhage accounts for the conjunctival ecchymosis which is practically always present and for any exophthalmos which may be present. Ocular palsies have been noted in some of the patients. Ophthalmoscopic examination was made in 44 of the 127 cases; in 11 of the 44, retinal haemorrhages were found, and in another case in which the retinae were examined post-mortem, haemorrhages were present; oedema was found in

6 cases. Perimetric examinations were made in only 7 cases, in two a central scotoma was present and in four cases there was contraction of the field. Seven cases of the series suffered from permanent impairment or complete loss of vision which has most often been due to a progressive optic atrophy; in some cases it is postulated that there have been degenerative changes in the retina, the result of vascular stasis with oedema. A footnote records that, since writing his paper, the author has met with the report of another case, which occurred in a deep sea diver; no notes of any ocular disturbance are, however, recorded with regard to this last case.

The bibliography runs to 68 items. It has only been possible to give the barest outline of this subject in our abstract, those who wish for further details should consult the original article; they will be amply repaid for any trouble that they may be put to in so doing.

R.R.J.

(2) **Ladd-Franklin, Christine, A. B.—Tetrachromatic vision and the genetic theory of colour.** *Amer. Jl. of Physiol. Optics,* October, 1923.

(2) **Ladd-Franklin's** paper urges the more universal recognition and teaching that there are four colours in the spectrum, red, yellow, green and blue, and proceeds briefly to review the theories on colour vision.

The author regrets that even yet the public have not freed themselves from Newton's conception of seven colours, his reasoning, in her opinion, being aesthetic. To quote from the paper: "the spectrum is counted in wave lengths about an octave long: in the music octave we recognize seven notes, so why not assign seven tones also to the colour octave?"

Helmholtz established three primary colours, but his theory in the author's view is pre-psychological and pre-evolutionary, while Hering's theory, though recognizing four distinct colour sensations, is pre-evolutionary.

A quotation from Troland's "Enigma of Colour Vision" on these two conceptions is given: "The Young-Helmholtz theory is preferred by physicists because it lays emphasis primarily upon the stimuli to vision, while the Hering theory receives more attention at the hands of the psychologists because its fundamental conceptions are derived from introspective analysis."

The evolutionary idea is then discussed, and can be briefly stated as "the development of a greater and greater specificity to the electro-magnetic vibrations of the visible spectrum." The evolutionary steps may be thus enumerated: (1) Achromatic vision, that is, a white sense only found in lower animals—complete

colour-blind individuals—peripheral retinal vision. (2) Dichromatic vision, perception of yellow and blue found in bees (v. Frisch) for example—partial colour-blindness—mid-peripheral retinal vision. (3) Tetrachromatic vision, an added perception of red and green.

The author, while admitting yellow, the controversial fourth colour, to be a secondary product, is convinced that it and white, also a secondary product, are "perfectly good unitary sensations."

E. MAXWELL.

(3) **Weekers, L. (Liège).—Light-Sense, Form-Sense and Colour-Sense. (Vision de la Lumière, des Formes et des Couleurs.)** *Arch. d'Ophtal.*, August, 1921.

(3) Is the anatomical basis of these subdivisions of the sense of sight identical? This question arises in every clinical observation of their dissociation.

Weekers publishes details of a case in which there was complete abolition of vision for form and colours in both eyes, contrasting strikingly with the retention of perception and projection of light. His patient was a healthy man, aged 37, severely injured in a mine accident. He was unconscious for about an hour. When he recovered his senses, his vision was unaffected. Sight began to fail about one month later; it deteriorated gradually until, after an interval of six months and rather suddenly, he became blind.

When he came under Weekers' observation, he could not perceive objects or the movements of any object, with either eye; but his perception and projection of light were prompt and accurate in all parts of the field of each eye. He responded to this test whether carried out by an ophthalmoscope mirror, electric lamp, a candle or match. The pupils were unequal; both were irresponsive to light and to accommodation. There was convergent strabismus of 20°, and the ocular movements were limited in all directions. The optic papillae were pearly white and presented the appearances of simple atrophy.

Syphilis and other constitutional diseases were excluded by rigorous investigation. Radiographic examination revealed a notable opacity at the base of the skull, in the median line, involving the sella turcica, the body of the sphenoid and the adjoining portion of the temporal bone. These findings and the onset of visual failure some time after the accident render it most probable that there had been a fracture of the cranial base, followed by a descending atrophy of the optic nerves induced by pressure on the tracts or the chiasma.

Following the notes of his case, the author discusses the various hypotheses which have been advanced to explain the dissociation referred to, but at too great length for reproduction here. He adheres to the view that the dissociation bears a definite relation to

the severity of the lesion in the optic radiations or the cortical centres. If the destruction of the nervous elements is incomplete they may retain some part of their functions in slight degree, or a partial restoration of function may ensue. In favour of this suggestion is the fact that the order in which the visual functions disappear is constant; first the chromatic sense, then the sense of form, and lastly perception of light. J. B. LAWFORD.

(4) **McCallie, Joseph M., Ph.D.—A critical study of the Snellen letters and the illiterate "E" tests.** *Amer. Jl. of Physiol. Optics,* October, 1923.

(4) **McCallie,** here states that noting variations in the results obtained when using Snellen letters, and the illiterate "E" tests, he made a careful investigation into the visual acuity of 470 pupils of a grammar school in New Jersey.

He used the letters and the "E" of a size constructed to be seen at 16 feet by the normal eye, and all the tests were carried out under similar conditions. The results with Snellen letters showed 18.6 per cent normal vision, 15.5 per cent. above normal, 65.8 per cent. subnormal: with the "E" 3.9 per cent. normal, 82.2 per cent. above normal, 8.1 per cent. subnormal. He also found that 13.7 feet was the average distance at which 688 eyes saw the 16 foot letters, and 23.2 feet the 16 foot "E". He attributes these discrepancies to the fact that with the "E" the observers, having only to determine in which direction the opening lies, discern it too readily, as it is the brightest side of the figure. Searching for a substitute for the "E" he made use of the accepted fact that the normal eye can just discern an object subtending one minute angle, the vertex of the angle being at the nodal point.

This allows an object just visible to the normal eye at 20 feet, a diameter of 0.0698 of an inch.

His substitute for the "E" consists of a set of cards (illustrations shown in the paper), containing figures of children and animals holding rings, in the centre of one of which in each card, is a dot 0.0698 of an inch in diameter. The ring and dot in the case of small children can be spoken of as racket and balls.

By two hundred children who saw 20 feet Snellen letters at an average of 22.20 feet, this dot was visible at an average of 20.90 feet. In addition to this strong suggestion of greater accuracy in determining visual acuity on the part of the dot tests, the author considers that it tends to eliminate guess-work. A familiarity with the general form of the letters may enable the observer, without seeing all the component parts, to name a letter correctly: in the case of the dot, judgment is solely passed upon whether there is, or is not, a retinal sensation produced by it.

E. MAXWELL.

(5) **Jess, Dr. A. (Giessen).—On the histological picture of copper opacity of the lens, a contribution to the question of lens nutrition. (Das histologische Bild der Kupfertrübung der Linse, ein Beitrag zur Frage der Linsenernährung.)** *Klin. Monatsbl. f. Augenheilk.*, April-May, 1922.

(5) **Jess** gives notes of a patient who was injured by a grenade explosion four years before any serious trouble made its appearance in the eye. At that time a spark from burning wood flew into the eye and caused a slight burn of the lower lid which rapidly healed but was followed by inflammation of the eyeball and defective vision. When seen by Jess the eye was suffering from severe irido-cyclitis. He was unable to find any scar in the cornea but found in the centre of the lens immediately beneath the lens capsule a typical greenish fire opal (*Sonnenblume*) opacity about 3 mm. in diameter with numerous rays extending to the periphery. The central part of the lens was clear but beneath the posterior capsule there was a greyish-white opacity which glittered a golden red with the slit-lamp. With the aid of the corneal microscope numerous similar opacities were to be seen in the vitreous. Vision was reduced to 4/50.

Radiography revealed a foreign body situated down and out in the ciliary region. As the sideroscope and the magnet had no influence on it, and as the eye got steadily worse, enucleation was performed. The foreign body was found to be copper. There was no injury to the lens and the foreign body must have entered through the sclera and remained embedded in the ciliary body.

The copper deposit in the lens reacted with ferrocyanide of potash and acetic acid, and lay in the space beneath the lens capsule. (Coloured plates illustrate the histological appearance.) The glistening cataract appearance (*Scheinkataract*), seen by focal but not by transmitted illumination, was due to the deposit that lay between the epithelium and capsule. This deposit was in the centre about 5μ thick but only about 2μ at the sides.

The point of interest is how the copper reached its position. The deposit was richest in that part of the lens that corresponded with the pupillary opening and was in contact with the aqueous.

Jess considers that the copper salts were dissolved in the aqueous and diffused through the epithelium, but were held up by the capsule and so spread laterally under the epithelium. He considers that the copper salt formed in the eye was in all probability a basic carbonate. He was, however, unable to reproduce the typical copper cataract experimentally in rabbits' eyes, although he made numerous experiments with different copper preparations.

Jess concludes his paper by pointing out that the deposit of copper in such cases throws some light on the normal diffusion

currents of the lens. A bibliography and two coloured plates accompany the paper.

E.E.H.

(6) **Aubineau and Opin.—Glioma of the retina resembling iridocyclitis. Early involvement of the ciliary body and iris. Buphthalmos. (Gliome rétinien à forme iridocyclitique avec envahissement précoce du corps ciliare et de l'iris et buphtalmie.)** *Arch. d'Ophtal.*, April, 1922.

(6) The authors publish clinical and histological notes of a case, one of a comparatively small group, in which the clinical appearances are so atypical that an error in diagnosis may and occasionally does occur and in some cases is determined only after removal of the eyeball. In this instance the clinical signs which at first misled the observers were briefly as follows:—the globe was of normal size and tension, but tender to touch; there was marked conjunctival and pericorneal injection; the cornea was quite clear and through it were visible masses of yellow and red material, thought to be composed of pus and blood, which filled the anterior chamber. The condition was thought to be either tuberculosis or metastatic iridocyclitis.

Four months later the eyeball had become buphthalmic, the anterior segment having become much enlarged; the anterior chamber was still filled by yellowish red material with a semi-liquid appearance. The eye was then excised and histological examination showed the existence of a typically gliomatous growth which had invaded the iris and ciliary body so that these structures were scarcely recognisable. The child died two months later with meningeal symptoms.

Aubineau and **Opin** have searched the literature and have found a small number of similar cases and append a list of references.

J. B. LAWFORD.

(7) **Kiep, W. (Cairo).—The use of butyn in ophthalmic practice.** *Bull. Obhthal. Soc. Egypt*, 1923.

(7) **Kiep** has used butyn in 2 per cent. solution in some fifty cases, including seven of trephining, four of iridectomy, one of cataract, and one of application of the cautery for corneal ulcer, and of thirty-six (by infiltration-anaesthesia) of trichiasis and of van Millingen's operation. He was completely satisfied with the results. Butyn should not be used with chlorides, such as adrenalin chloride, but this difficulty may be got over by combining it with epinephrin. All traces of alkali must be absent from instruments, bottles, etc., since alkali causes immediate precipitation of butyn.

S.S.

BOOK NOTICES

Diseases of the Optic Nerve. Notes of Cases taken at the Government Ophthalmic Hospital, Madras, 1919 to 1922. Madras: Printed by the Superintendent, Government Press, 1923.

These are notes on a second series of cases of optic nerve diseases, a former series having been published in 1919. Two similar reports upon diseases of the choroid and retina have also been issued (*vide* p. 136). Details of 408 cases are included in the present issue. These publications constitute a mine of information for those who are interested in the subjects dealt with, but their value would be greatly augmented by the addition of a short summary of deductions from the material enclosed. Reference is made to the blood, renal, oral, and venereal conditions, whilst mention is made of other constitutional states which may bear on the diseases.

The reader will be struck by the large number of patients whose parents were cousins; about 50 per cent. of the general population of Southern India are, however, the issue of such marriages. One notes that cases, which are obviously not those of pure optic atrophy, have been included; also some of the notes are rather difficult to follow; a little more care in compilation would have greatly enhanced the value of a very interesting communication. Further issues of the notes will be looked forward to with interest; their publication is of considerable value; it may be questioned whether any other similar institution is doing this form of work; and the example might be imitated with profit.

R. H. ELLIOT.

La Tuberculose du Tractus Uvéal. Infection, Superinfection. Anatomie pathologique et pathogénie. By HENRY LAGRANGE. Paris; Gaston Doin. pp. 192. 1924. Price, 25 francs.

This volume, described by the author as a study of the pathological anatomy and pathogenesis of tuberculosis of the uveal tract, is based upon a critical analysis of a relatively large number of records of tuberculous lesions of the anterior or posterior segment of the eyeball, and experimental researches on lines indicated by this analysis. The result is a work of great merit, in the production of which the publisher has played his part very skilfully. The book is beautifully printed on superior paper and the illustrations in the text (29 in number) and the three coloured plates (with 14 figures) reach a consistently high standard. The letterpress is singularly free from typographical errors.

To do justice to Lagrange's work within the usual limits of a book notice is beyond our powers: we propose therefore to indicate briefly the scope and general plan of the book and to give in full the conclusions with which the author furnishes his readers. In addition we give it as our opinion that every ophthalmic surgeon, in his own interests, should find an opportunity to read or at least to consult this monograph.

The book is in three parts.

Part I, entitled "Anatomical and Clinical Studies," begins with an historical section from which we learn that the published records of ocular tuberculosis date from 1837. In that year Gueneau de Mussy reported that in an autopsy on a case of phthisis he found numerous "granulations" in the retina, the structure of which was similar to that of granulations in other organs. This was followed in 1855 by an observation published by von Graefe concerning a hog's eye which was filled by a "tubercular tumour": von Graefe remarked that, so far as he was aware, no similar condition had been observed in man. Experimental research into ocular tuberculosis began in 1877 when Haensell for the first time induced tuberculosis of the uveal tract in an animal, by inoculation into the anterior chamber.

The following section deals with the various forms of tuberculosis of the uveal tract, (*a*) in the posterior segment of the globe, (*b*) in the anterior: the latter part contains two illustrations, one clinical, one histological, of diffuse tuberculosis of the iris. The next chapter consists of an "analytical study" of all the author's observations: it contains clinical and pathological details of twelve cases and in the majority of them excellent illustrations of the anatomical and histological appearances. It is followed by a chapter entitled "a synthetic study of observations." These two chapters extend to 60 pages; they are full of interest and worthy of careful study.

Part II. "A study in pathogenesis" contains two chapters. In the first the author deals with tuberculous infection in its more general relations and devotes a section to the consideration of the condition of acquired immunity, observed clinically and confirmed experimentally, to which the term *allergie* has been applied, and another section to the contrasted condition, in which some interruption to this acquired immunity has occurred (e.g. hepatic diseases), described by the term *anergie*. In another section super-infection or Koch's phenomenon is discussed at some length.

The second chapter concerns infection of the uveal tract.

Part III, of 40 pages, is devoted to experimental researches. One chapter deals with infection by way of the anterior chamber, another with inoculation and super-infection by the conjunctiva and the last with experimental super-infection of the uveal tract.

At the end of each chapter is a bibliography in which the references are more detailed than in many such lists. At the end of the book is an alphabetical list of authors with paged references, followed by a table of contents. The latter might be more conveniently placed at the beginning of the book.

CONCLUSIONS

The tuberculous lesions of the uveal tract which we have investigated anatomically and clinically involve sometimes the anterior segment of the eye, sometimes the posterior; in the first instance they attack especially the base of the iris, in the second the equatorial region of the choroid. These facts deserve attention, for the careful study of their characters may help to determine the difference which exists in respect of pathogenesis between the above lesions and miliary tuberculosis of the choroid or of the iris. This latter represents the participation of the uveal tract in generalized bacillary infection such as occurs in severe primary infection and in subjects in a state of *anergie*. The present research on the other hand relates to forms of uveal tuberculosis occurring in subjects in a condition of *allergie*, and in our view represent lesions of super-infection.

The following are the conclusions based upon our anatomical and pathological investigations:

1. Tuberculous lesions of the anterior segment of the eye show little tendency to invade the posterior part. Their extension into contiguous structures is forward, towards the iris angle whence they invade the canal of Schlemm and perforate the wall of the globe. This extension appears to be influenced by two conditions (*a*) the resistance of the tendon of the ciliary muscle and especially of the crystalline lens and its suspensory system which always escape invasion, (*b*) the direction of the flow of intraocular fluid carrying the noxious elements towards the canal of Schlemm.

2. The propagation of tuberculous lesions of the choroid of the exophytic type occurs in the zone of the vasae vorticosae, the perivascular lymphatic sheaths of which play an accessory part in the escape of intraocular fluids. In mixed and endophytic forms extension by contiguity into the retina and thence to the optic nerve is the rule.

3. In the tuberculomata examined during this research tubercle bacilli have not been detected by direct examination: the lesions to which they give rise are restricted to a circumscribed area of the uveal tract and are always accompanied by changes in or destruction of the uveal pigment.

Resumé of observations made during experimental research.—1. Injection of tuberculin into the anterior chamber of a rabbit free from tuberculous infection is not followed by a specific reaction,

and successive injections do not induce sensitivisation; but in an allergic animal an extremely minute dose of tuberculin provokes a reaction characterized histologically by changes in the corneal stroma and by an intense and rapid capillary reaction. Inoculation of a guinea-pig with portions of uvea showing such reaction has never yielded positive results which could be considered as confirmatory of bacillary transference.

2. Inoculation of tubercle in a rabbit has been obtained by the instillation of bacilli from man into the animal's conjunctival sac. Dissemination of this infection takes place by the lymphatics (cervical and thoracic glands); it never spreads to the deep tissues of the eye and does not attack the uveal tract. Infection of this region has not been effected by subconjunctival inoculation with tubercle bacilli nor have we succeeded in inducing, by tuberculous super-infection of the conjunctiva, lesions deeper than the sclera. This is not opposed to the hypothesis of the uveal, i.e. endogenous, origin of tuberculous sclero-keratitis and episcleritis.

3. While inoculation with an emulsion of tubercle bacilli into the anterior chamber of a non-allergic rabbit is followed by the slow development of diffuse lesions, relatively rich in bacilli, experimental super-infection by inoculation in the anterior chamber induces a lively reaction and the immediate development of localized and rapidly progressive lesions, in which bacilli, difficult to find, are agglutinated in clusters and are undergoing lysis.

The macroscopic histological and bacterial characters of these experimental lesions are very similar to those observed in specimens obtained from clinical cases. The general characters of the lesions of super-infection with tubercle are comparable to the characters (anatomical pathological and bacterial) of localized tuberculosis of which the greater number belong to the group of surgical tuberculosis.

POSTPONEMENT OF THE INTERNATIONAL CONGRESS, 1925

We have received the following communication from Professor Uhthoff.

" RECTIFICATION "

" CONCERNING THE POSTPONEMENT OF THE INTERNATIONAL OPHTHALMOLOGICAL CONGRESS"

"In the September, 1923 (p. 424), number of the BRITISH JOURNAL OF OPHTHALMOLOGY a declaration is published by the French and Belgian Ophthalmological Societies by which these corporations

are endeavouring to give their reasons for their own keeping away from the London International Ophthalmological Congress, if the Germans were invited. In addition to their former boycott-declarations they state therein that the German medical corporation had proposed not to treat any French or Belgian patient and that the foundations of medical ethics had been infringed thereby.

"This interpretation is *misleading*. All that the French press has published as a general principle on the part of German doctors is nothing but a misrepresentation of a protesting and demonstrative measure taken by German medical men at the time of the 'Ruhr-Invasion' (January, 1923), against which, as it is well known, the British Government likewise protested as being illegal.

"It may be well called to mind all the various hardships and damages to health the peaceful population had to endure, amongst others the evacuation of hospitals, even those with contagious diseases, and the cruel expulsion of so many thousands of people—men, women and children—from the occupied territories including medical men, that at the time it was not to be wondered at that German doctors joined in supporting their so much tormented countrymen in their spontaneous 'passive resistance' by declining to give medical treatment to unlawful invaders. But even then the German doctors, without, however, accepting any payment for it, in cases of emergency *did not refuse to render first examen and first aid*. This can be proved by facts.

" The refusal of other treatment was the more plausible as the troops had brought along with them their own military doctors so that they could be attended by them.

"It will thus be well conceived that *in this connection only the* refusal must be considered and we are certain that no other nation if treated in the same way, would ever think of reproaching their own men in participating in 'passive resistance' if carried out in such a humane manner.

"The French declaration and its press have passed with silence over all these facts and thereby given a totally wrong impression of the connection. *It is a matter of common sense that we are treating patients of other nations whenever they want and require our help.*

"The renewed boycotting of the German doctors is nothing else but a continuation of previous resolutions, whereby a political note has been carried into scientific connections.

" The resolution of the Congress at Washington to hold a 'really' international meeting in 1925 was a first step in the right direction to deliver science from politics, and the London Committee had seconded this by sending out invitations to that effect to the various nations.

"If it is the intention of restoring the international congress and just relations amongst the nations and their various scientific societies, then it will be necessary to disregard those who are by political reasons not willing to come. It seems to be the only course of making a headway. The Physiological Congress already took place in Edinburgh in July, 1923, at which Germans participated.

"(By Order), M. UHTHOFF,
Breslau."

NOTES

Death

WE regret to record the recent death of Dr. JOHANNES KÖLLNER, Professor of Ophthalmology in Würzburg, which occurred on February 7th. He was 43 years of age.

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North of England Ophthalmological Society

AT the annual meeting of the Society the following officers were elected for the year 1924. President: H. Horsman McNabb (Manchester); Vice-President: H. Edmondson (Burnley). Members of Committee: T. Milnes Bride (Manchester) and D. Matheson Mackay (Hull). Treasurer: Harry Lee (Leeds). Secretary: Percival J. Hay (Sheffield).

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Correction

IN Dr. Traquair's article on perimetry in the February number, in the letterpress below Figure 4, page 56, the degree sign in the last four numbers has been substituted for the decimal point. The paragraph should run as follows: isopters from without inwards for 20/330, 5/330, 1/330, 2/2000, 1/2000; corresponding visual angles are: 3°28′, 52.1′, 10.4′, 3.4′, and 1.7′.

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Returns for St. Margaret's Hospital for Ophthalmia Neonatorum 1922-23

THE returns are most satisfactory: they indicate that more cases are being admitted each year and that the results are improving. The results depend entirely on how early the cases are being

admitted to the hospital. A proportion of the cases are still admitted with the damage to the eyes already present. The need for immediate transfer to the hospital as soon as discharge and swelling of the lids are present is urgent. It is certain that if all cases were admitted at once, very few would leave the hospital with one or both eyes damaged.

No. of Children admitted.		No. of Mothers.		No. of Children discharged with single blind eye.		No. of Children discharged both eyes impaired.		No. of Children discharged with single eye impaired.	
1922	1923	1922	1923	1922	1923	1922	1923	1922	1923
213	225	135	164	5	3	7	7	20	12

The figures for London are as follows:

Year.	No. Notified.	No. in St. Margaret's Hospital.
1920	1186	252
1921	1076	213
1922	866	213
1923	756	231

FUTURE ARRANGEMENTS

May 1-3.—Annual Congress, Ophthalmological Society of the United Kingdom, Glasgow.

May 6.—Medical Faculty of Paris. Ophthalmological Clinic of the Hôtel-Dieu. Advanced Course (*Cours de Perfectionnement*).

Professor F. de Lapersonne, assisted by Doctors Velter, Hautant, Prelat and Cousin, will hold an advanced course, beginning on May 6, with clinical examinations, practical operative work, and laboratory manipulations.

Lessons and practical exercises will be arranged every day. A special certificate of the Faculty of Medicine of Paris will be issued at the end of the course.

French and foreign medical men and students who desire to attend should apply to the Secretariat of the Faculty of Medicine. The fee for the course has been fixed at 150 francs.

May 12.—Congrès de la Société française d'Ophtalmologie (Paris).

June 3.—Midland Ophthalmological Society, at the Coventry and Warwickshire Hospital.

June 12-14.—Deutsche ophthalmologische Gesellschaft, Heidelberg.

June 13.—Royal Society of Medicine. Section of Ophthalmology (Annual Meeting).

July 2-5.—Oxford Ophthalmological Congress.

The Doyne Memorial Lecture will be delivered by Dr. T. Harrison Butler on "Focal illumination of the eye, with special reference to the clinical use of Gullstrand's Slit-Lamp." A Discussion will be held on "The general principles of the treatment of convergent concomitant strabismus" (excluding details of operations) to be opened by Dr. E. Landolt of Paris and Dr. Ernest Thomson of Stirling. A discussion on "Medico-legal Ophthalmology" will also be held.

July 22-25.—British Medical Association. Ninety-Second Annual Meeting at Bradford. Section of Ophthalmology. President: A. Maitland Ramsay, M.D.; Vice-Presidents: R. J. Coulter, M.B., A. L. Whitehead, M.B.; Hon. Secretaries: J. D. McCulloch, M.B., Humphrey Neame.

September 1-6.—Course on the slit-lamp at the Ophthalmic Clinic of Zurich.

In answer to a number of applicants who could not be accommodated last year, Professor Vogt will hold a course in slit-lamp work, combined with demonstrations of the fundus in red-free light, from September 1 to 6, inclusive, 1924. The programme will be the same as that of last year. The number of students to be admitted to the course is limited. Application should be made to Professor Vogt, Universitäts Augenklinik, Zurich.

October 7.—Midland Ophthalmological Society (Annual Meeting) at the Birmingham and Midland Eye Hospital.